In the Claims

Claims 1, 3, 5, 7-8, 10 and 13 are withdrawn.

Claims 6, 11 and 12 are being amended.

Claims 14-43 are being added.

1. (Withdrawn) A system comprising:

an extruder designed to convey a first stream of a fluid, polymeric material in a downstream direction and having a blowing agent port constructed and arranged to inject a blowing agent into the stream, the extruder adapted to admix the stream with the blowing agent to form a single-phase solution of polymeric material and blowing agent;

a nucleator constructed and arranged to divide the single-phase solution of polymeric material into separate portions and to continuously nucleate each of the separate portions at a rate sufficient to form a microcellular polymeric material.

2. (Original) A method comprising:

establishing a stream of polymeric material flowing at a rate of at least about 5 lbs per hour within a polymer processing space between a rotating screw and an extruder barrel;

introducing, into the stream of polymeric material, a blowing agent through a plurality of orifices of the extruder barrel while passing the orifices with a flight of the rotating screw; and

admixing the polymeric material and the blowing agent to form a single-phase solution of polymeric material and blowing agent.

3. (Withdrawn) A system comprising:

an extruder having a screw constructed and arranged to rotate within a barrel to establish a stream of fluid, polymeric material having a flow rate of at least about 5 lbs per hour,

the extruder including a plurality of orifices connected to a blowing agent source and constructed and arranged to introduce the blowing agent into the stream of fluid, polymeric material while being passed by a flight of the rotating screw,

the extruder designed to admix the polymeric material and the blowing agent to form a single-phase solution of polymeric material and blowing agent.

4. (Original) A method comprising:

providing an extruder having an inlet at an inlet end thereof designed to receive a precursor of foamed material, an outlet at an outlet end thereof designed to release foamed material from the extruder, an enclosed passageway connecting the inlet with the outlet constructed and arranged to advance a fluid polymeric stream within the passageway in a downstream direction from the inlet end toward the outlet end, and a nucleation region at which a single-phase solution of fluid polymeric material and blowing agent flowing therethrough is nucleated;

establishing a stream of fluid polymeric material flowing in the extruder in the downstream direction;

introducing a fluid that is a gas under ambient conditions into the stream at an injection location of the extruder; and

maintaining the stream, downstream of the injection location and upstream of the nucleation region, within the extruder, under pressure varying by no more than about 1500 psi.

5. (Withdrawn) A system comprising:

an extruder having an inlet at an inlet end thereof designed to receive a precursor of foamed material, an outlet at an outlet end thereof designed to release foamed material from the extruder, and an enclosed passageway connecting the inlet with the outlet constructed and arranged to advance a fluid polymeric stream within the passageway in a downstream direction from the inlet end toward the outlet end, and a nucleation region at which a single-phase solution of fluid polymeric material and blowing agent flowing therethrough is nucleated;

the extruder including a blowing agent port constructed and arranged to inject blowing agent upstream of the nucleation region, the extruder designed to maintain the fluid polymeric stream, downstream of the injection location and upstream of the nucleation region, within the extruder, under pressure varying by no more than about 1500 psi.

6. (Currently Amended) A method comprising:

establishing a stream of a fluid, single-phase solution of a precursor of foamed polymeric material and a blowing agent; and

~~continuously~~ nucleating the solution by ~~continuously~~ decreasing the pressure ~~within successive, continuous portions~~ of the flowing, single-phase stream at a rate which increases; and

forming a microcellular polymeric material.

7. (Withdrawn) A polymer extrusion apparatus including a polymer nucleator having a polymer receiving end constructed and arranged to receive a fluid, non-nucleated, single-phase solution of a polymeric material and a blowing agent, a nucleated fluid releasing end, and a fluid pathway connecting the polymer receiving end to the releasing end that decreases in cross-sectional dimension in a downstream direction, the apparatus constructed and arranged to feed a fluid, non-nucleated, single-phase solution of a polymeric material and a blowing agent to the nucleator receiving end and to extrude, continuously, microcellular polymeric material in the shape of a continuous extrudate.

8. (Withdrawn) A polymer forming die including an annular inlet at an upstream end thereof for receiving a single-phase, homogeneous solution of polymeric fluid and blowing agent that is a gas under ambient conditions, an annular outlet at a downstream end thereof for releasing foamed polymeric material, and a fluid pathway connecting the inlet with the outlet, the fluid pathway including a first, upstream section defining a nucleating pathway and a second, downstream section connecting the nucleating pathway with the outlet, the downstream section defining an annular gap of essentially constant width and increasing radius in a downstream direction.

9. (Original) A method comprising:

nucleating a single-phase solution of polymeric material and blowing agent, and

shaping and releasing shaped microcellular polymeric material, around a wire, to ambient conditions essentially immediately after nucleation, the microcellular polymeric material having cells that are free of a non-atmospheric gas.

10. (Withdrawn) A system for producing microcellular polymeric material, comprising:

an extruder having an inlet at an inlet end thereof designed to receive a precursor of microcellular polymeric material, an outlet at an outlet end thereof designed to release microcellular polymeric material from the extruder, and an enclosed passageway connecting the inlet with the outlet constructed and arranged to receive a blowing agent and to contain a homogeneous, single-phase solution of the blowing agent with the precursor in a fluid state at an elevated pressure within the passageway and to advance the solution as a fluid stream within the passageway in a downstream direction from the inlet end toward the outlet end, the enclosed passageway including a nucleating pathway in which a single-phase solution of blowing agent and microcellular polymeric material precursor passed therethrough can be nucleated, the nucleated material being released directly to ambient conditions.

wherein the extruder is adapted to receive wire and to position the wire in communication with the passageway.

11. (Currently Amended) A method comprising continuously extruding microcellular polymeric material ~~having cells of essentially uniform size of less than about 50 microns average size~~ from a single-phase solution of polymeric material and blowing agent contained in extrusion apparatus including a nucleating pathway, the blowing agent present in the solution in an amount less than about 80 percent saturation concentration as determined at the lowest pressure in the system after the point of blowing agent injection prior to the nucleating pathway.

12. (Currently Amended) A method comprising:

providing a single-phase solution of polymeric material and blowing agent; and

continuously extruding said single-phase solution through an orifice constructed and arranged to provide a microcellular polymeric material ~~precursor having cells of essentially uniform size of less than about 50 microns average size and~~ having an average cross-sectional dimension of less than 0.5 mm.

13. (Withdrawn) An article obtained by continuously introducing a blowing agent that is an atmospheric gas under ambient conditions into a polymeric material comprising a polymer

selected from the group consisting of crystalline and semi-crystalline polymeric material and causing the material to foam to form a microcellular polymeric material in the shape of a continuous extrusion.

14. (New) The method of claim 2, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 0.1 GPa/sec to create sites of nucleation.

15. (New) The method of claim 2, wherein the blowing agent is present in the single-phase solution in an amount less than about 80 percent saturation concentration as determined at the lowest pressure in the extruder barrel after the point of blowing agent injection and prior to nucleating the single-phase solution.

16. (New) The method of claim 2, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a rate sufficient to form microcellular polymeric material.

17. (New) The method of claim 2, wherein the flight of the rotating screw passes each orifice at a rate of at least 1 pass per second.

18. (New) The method of claim 2, comprising introducing, into the stream of polymeric material, the blowing agent through at least about 10 orifices.

19. (New) The method of claim 2, comprising introducing, into the stream of polymeric material, the blowing agent through at least about 100 orifices.

20. (New) The method of claim 2, wherein at least some of the orifices are located at different radial positions around the extruder barrel.

21. (New) The method of claim 2, comprising passing the orifices with an un-broken flight of a screw.

22. (New) The method of claim 2, wherein the flight of the rotating screw periodically blocks each orifice.

23. (New) The method of claim 2, wherein the blowing agent is a supercritical fluid in the extruder barrel.

24. (New) The method of claim 2, further comprising extruding the single-phase solution to form a microcellular polymeric material.

25. (New) The method of claim 24, further comprising nucleating the single-phase solution while extruding the solution through a die.

26. (New) The method of claim 25, wherein the pressure drop rate increases in a downstream direction, while extruding the solution through the die.

27. (New) The method of claim 2, further comprising metering the mass of the blowing agent introduced into the stream of polymeric material.

28. (New) The method of claim 2, wherein the stream of fluid, polymeric material is established in the extruder at a rate of at least about 40 lbs per hour.

29. (New) The method of claim 4, comprising maintaining the stream, downstream of the injection location and upstream of the nucleation region, within the extruder, under pressure not less than about 2000 psi and not greater than about 4500 psi.

30. (New) The method of claim 4, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 0.1 GPa/sec to create sites of nucleation.

31. (New) The method of claim 4, further comprising extruding the single-phase solution to form a microcellular polymeric material.

32. (New) The method of claim 6, comprising nucleating the solution while extruding the solution through a nucleating pathway within a die.

33. (New) The method of claim 32, wherein the cross-sectional area of the nucleating pathway decreases in a downstream direction.

34. (New) The method of claim 6, comprising continuously nucleating the solution by continuously decreasing the pressure within successive, continuous portions of the flowing, single-phase stream at a rate which increases.

35. (New) The method of claim 9, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 0.1 GPa/sec to create sites of nucleation.

36. (New) The method of claim 9, wherein the blowing agent is a supercritical fluid in the extruder barrel.

37. (New) The method of claim 11, comprising continuously extruding microcellular polymeric material having cells of less than about 50 microns average size.

38. (New) The method of claim 11, comprising maintaining the stream, downstream of blowing agent injection location and upstream of the nucleation region, within the extruder, under pressure not less than about 2000 psi and not greater than about 4500 psi.

39. (New) The method of claim 11, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 0.1 GPa/sec to create sites of nucleation by passing the solution through the nucleating pathway.

40. (New) The method of claim 11, wherein the nucleating pathway is located within a die of the extrusion apparatus and further comprising nucleating the solution while extruding the solution through the die.

41. (New) The method of claim 12, further comprising nucleating the single-phase solution of polymeric material and blowing agent at a pressure drop rate of at least about 0.1 GPa/sec to create sites of nucleation.

42. (New) The method of claim 12, wherein the blowing agent is present in the single-phase solution in an amount less than about 80 percent saturation concentration as determined at the lowest pressure in the extruder barrel after the point of blowing agent injection and prior to nucleating the single-phase solution.

43. (New) The method of claim 12, comprising nucleating the solution while extruding the solution through a die.